FEDERATION OF NIGERIA

ANNUAL REPORT

ON THE

Department of Agricultural Research

FOR THE YEAR 1954-55

NINEPENCE NETT

COMMONWEALTH MYCOLOGICAL INSTITUTE
13 JUL 1957

1957
LAGOS: FEDERAL GOVERNMENT PRINTER

PUBLICATIONS

The following is a list of some of the Government Publications which may be obtained (post free in Nigeria) from The Federal Government Printing Department, Lagos. A complete list may be obtained gratis on application.

Money Orders and Postal Orders should be made payable to The Federal Government Printer, Lagos. Postage stamps are not accepted.

Departmental Annual Reports

Audit, 1955, 9*d*.
Accountant-General's, 1951 and 1952-53, 10*s* each.
Administrator-General's Report, 1954-55, 9*d*.
Agriculture, 1950-51, 1953-54, Parts I & II, 9*d* each.
Antiquities Report, 1954-55, 9*d*.
Chemistry Department, 1952-53, 1953-54, 1954-55, 9*d* each.
Civil Aviation, 1952-53, 1953-54, 9*d* each.
Commerce and Industries, 1951-52, 1952-53, 1954-55, 9*d* each.
Co-operative Societies, 1951-52, 9*d*.
Department of Social Welfare, W. R., 1954-55, 9*d*.
Education, 1952-53, 1953-54, 9*d* each.
Forest Administration, 1951-52, 1952-53, 9*d* each.
Geological Survey, 1951-52, 1952-53, 1953-54, 9*d* each.
Labour Report, 1953-54, 9*d*.
Land Department, 1954-55, 9*d*.
Marine, 1952-53, 1953-54, 9*d* each.
Medical, 1951-52, 1952-53, 1953-54, 9*d* each.
Meteorological, 1953, 9*d*.
Mines, 1950-51, 1952-53, 2*s*-6*d* each; 31-3-54 and 31-3-55, 9*d* each.
Post Office Savings Bank, 9*d*.
Statistics, 1951-52, 1953-54, 1954-55, 1955-56, 9*d* each.
Survey, 1950-51, 1951-52, 9*d* each.
Treatment of Offenders, 1950-51, 1953, 9*d* each.
Veterinary Report, Western Region, 1952-54, 9*d*.

Reports General

Accounts of Electricity Corporation, 1952-53, 9*d*.
Accounts of the Western Regional Development Board, 1951-52, 9*d*.
An Agricultural Note Book by T. A. Phillips, 5*s*.
Audit of Accounts of Nigeria, 1951, 1952, 31-3-54, 9*d* each.
Audit of Accounts (Nigerian Railway), 31st March, 1953, 31-3-54, 9*d* each.
Colony Development Board, 1950-51, 31-3-55 and 31-3-56, 9*d* each.
Conference on the Nigerian Constitution, July and August 1953, 9*d*.
Conclusions of the Government of the Federation on the Report of the Grading Teams and Reviewing Body for the Federal Public Service (including the Southern Cameroons) 1956, 1*s*-6*d*.
Desirability and Practicability of Establishing a Central Bank in Nigeria for promoting the Economic Development of the Country, 9*d*.
Economic Development of Nigeria, 12*s*.
Estimates of Nigeria, 1950, 1952-53, 20*s* each.
Estimates of the Southern Cameroons 1956-57, 10*s*.
Estimates (with Memorandum):—
Eastern Region, 1953-54, 1954-55, 10*s* each.
Estimates Supplementary (Regional), 1954-55, 10*s*
Government of Nigeria, 1953-54, 1954-55, 1955-56 and 1956-57, 20*s* each.
Northern Region, 1953-54, 1954-55 and 1955-56, 10*s* each.
Western Region, 1953-54, 1954-55, 1956-57, 10*s* each.
Fiscal Commissioner Report on Revenue Allocation, 1*s*.
Governor-General's Speech: March 1955, 6*d*.
Grants-in-Aid of Medical and Health Services, 6*d*.
Handbook of Commerce & Industries (2nd Ed.), 6*s*.
Inquiry into the Circumstances and Causes of a Railway Accident near Ilugun Station on 15th October, 1952, 9*d*.
International Tin Agreement Participation, 9*d*.
Land Tenure in the Yoruba Province, *Ward Price*, 7*s*-6*d*.
Native Administration in the British African Territories, Part III, 17*s*-6*d*; Part IV, 5*s*.
Nigeria Trade Journal, Vol. 4, No. 3, 1*s*-6*d*.
Nigerianization of the Civil Service Report by Sir Sydney Phillipson and Mr Adebo, 2*s*.
Notes on Land Tenure in Benin Province, 9*d*.
Population Census of Nigeria, 1952-53, 5*s*.
Population Census of Western Region of Nigeria, 1952, 20*s*
Proposals for the Future Financing of the Nigerian College of Arts, Science and Technology, 9*d*.
Production of Vegetable Oils and Oil Seeds in West Africa, 1*s*-3*d*.
Progress Report on Local Government in Northern Region, 1*s*-6*d*.
Public Relations Office, Reorganisation, 9*d*.
Recruitment and Training of Nigerians for Senior Posts in the Government Service of Nigeria, 6*d*.
Report of the Grading Teams and Reviewing Body by Randell, for the Federal Public Service, 1956, 2*s*.
Statement of Policy for Future Regulation of Grants-in-Aid of the Medical and Health Services, etc., 6*d*.
Trade Report, 1951, 1952, 1953, 20*s* each.

Laws of Nigeria

Laws of Nigeria, 1950, 1951 and 1955, Stiff—£1-1*s*. Limp—17*s*-6*d*.
Revised Laws of Nigeria, 1948, Vols. I-XII, Limp—£10-10*s*.
Separate volumes are not sold.

CONTENTS

	Pages
Foreword by Hon. Minister	3
Staff List	4
Report by the Director	5
Sectional Reports :	
Chemistry	10
Botany	10
Rice Research Scheme	12
Plant Pathology	13
Maize Rust Research Scheme	16
Entomology	17
Publications	24

FOREWORD

By the Minister of Research and Information

The need for raising the standard of living in Nigeria has never been more important than at the present time. The rapid increase in population now taking place together with the plans underway for industrialisation will of necessity entail a more intensive use of the land, but this will not be possible without a high level of technical efficiency in the production of both food crops and export crops.

The following pages show the lines of work being pursued in the development of more diverse and better types of food crops for the people and the progress being made with maize and rice as well as the improvement of cash crops such as cocoa. The fight against diseases and pests which waste so much of the farmers' efforts is gaining ground particularly in cocoa production, where success in the application of the results of control measures against black-pod disease devised by the Department of Agricultural Research has been spectacular. However, gratifying these results may be, it must be appreciated that not all the lines of agricultural research at present being pursued are likely to prove as spectacular, or to provide answers to farmers' problems until after several years of patient investigation and sustained endeavour.

Shortage of staff continues to hamper research activities and it is to be hoped that young Nigerians with a bent for scientific research will shortly be forthcoming to accept the challenge offered in the development of the Natural Resources of their country.

KOLAWOLE BALOGUN,
Minister of Research and Information

Staff List as at 31st March, 1955

(including Officers of the Maize Rust Research Scheme and the Rice Research Scheme)

Acting Director of Agricultural Research :

Dr J. M. Waterston, B.SC., PH.D. (EDIN.), A.I.C.T.A. (Resumed duty 22-9-54)

Principal Research Officer :

C. A. Thorold, M.A. (OXON), A.I.C.T.A. (Resumed duty 7-4-54) .. .. *Administration and Plant Pathology*

Senior Specialist Officers :

W. E. Freeman, B.SC. (LOND.), A.R.C.S., A.I.C.T.A. (Retired with effect from 1-6-54) .. .. .. *Senior Botanist*

Dr H. Vine, B.SC., PH.D. (LOND.), A.R.I.C. (Resumed duty 1-3-55) .. .. *Senior Chemist*

J. R. G. Sutherland, B.SC., AGRIC. (MCGILL). (Contract terminated 17-4-54) .. .. *Senior Entomologist*

Specialist Officers :

J. T. Davey, B.SC. (BRISTOL), A.I.C.T.A. (On secondment to French Sudan) .. .. *Entomologist*

J. L. Gregory, B.SC. (SHEFFIELD), DIP. AGRIC. (CANTAB.), DIP. TROP. AGRIC. (TRINIDAD) .. .. *Entomologist*

J. E. Y. Hardcastle, B.SC. (DUNELM), DIP. AGRIC. (CANTAB.), DIP. TROP. AGRIC. (TRINIDAD) (Resumed duty 24-3-55) .. .. *Botanist*

S. R. Chant, B.SC. (EDIN.), DIP. AGRIC. (CANTAB.), DIP. TROP. AGRIC. (TRINIDAD) (Assumed duty 12-8-54).. *Plant Pathologist*

B. D. A. Beck, B.SC. (MANCH.), DIP. AGRIC. SCI. (CANTAB.), DIP. TROP. AGRIC. (TRINIDAD) (Assumed duty 25-8-54) .. .. *Botanist*

W. D. Clayton, B.SC. (LOND.), A.R.C.S. (Assumed duty 1-12-54) .. .. *Ecologist*

4 *Vacancies*

Maize Rust Research Schemes R.471 and R.471A

Senior Principal Scientific Officer :

Vacant

Senior Scientific Officer :

Dr W. R. Stanton, B.SC. (READING), PH.D. (LOND.) (Resumed duty 14-7-54) .. .. *Geneticist*

Scientific Officer :

R. H. Cammack, B.SC. (ST. ANDREWS) (Resumed duty 25-10-54) .. .. *Mycologist*

Rice Research Scheme R.224

Senior Specialist :

Vacant

Agricultural Officer :

J. O. Goss, B.SC. AGRIC. (LOND.) (Assumed duty 28-7-54) .. .. *Temporary Agricultural Officer*

Superintendents, etc.

A. O. Bamtefa .. .. *Agricultural Superintendent*

2 Vacancies .. .. *Laboratory Superintendents*

Administrative Assistant

M. I. Ntephe (Resumed duty 6-2-54) .. .. *Administrative Assistant, Grade II*

Annual Report on the Department of Agricultural Research for the Year 1954-55

Report by the Director

Introduction

Consequent on the new constitution, which came into effect on 1st October, 1954*, arrangements were made for the establishment of a Federal Department of Agricultural Research under the direction of a Director of Agricultural Research.

As this is the first Annual Report prepared since the post of Director was made, I venture to set out below a brief indication of some of the duties and activities connected therewith.

The Director is responsible to the Federal Minister of Natural Resources and Social Services, for the execution of an approved agricultural research programme. The Director is also charged with duties of International or Inter-territorial interest. He is a member of the Managing Committees of the West African Cocoa Research Institute and the West African Institute for Oil Palm Research, and of the Board of the Faculty of Agriculture of the University College, Ibadan. He is also Chairman of the Technical Committee on Agriculture which advises the Council of Natural Resources on Agricultural matters including research and legislation. One particular aspect of the latter, is the responsibility of safeguarding all regions of Nigeria against the introduction of plant diseases and pests. The Technical Committee held its first meeting on 23rd-26th March, 1955 and has submitted a report containing recommendations for the integration of research now being undertaken by the University College, Ibadan, and Federal and Regional Departments. The formation of this Technical Committee was a result of a decision taken at a Conference on Natural Resources, Lagos, held on 17th-18th February, 1955 at which all regions were represented. Details of an agreed policy on Natural Resources will be issued shortly as a White Paper.

Administration

Mr R. Johns, O.B.E., Inspector-General of Agriculture, proceeded on retirement in January 1955, after nearly thirty years in the Colonial Agricultural Service, of which six were spent in Nigeria.

The Department of Agricultural Research remained under 50 per cent strength and this shortage of technical staff continued to constitute the limiting factor to progress with research projects.

The Department lost two Senior Specialists, one on retirement and the other on termination of his contract, but these were offset by the arrival of three specialists and one Temporary Agricultural Officer.

Of a total Federal Specialist Staff establishment of 20, two were on attachment on secondment (1 Senior Chemist and 1 Entomologist) in the Western Region and in the French Sudan, six were new appointments due to arrive between 1955-57, four were unfilled, leaving a total of eight, of whom two were tied down by administrative duties.

A similar picture presented itself for staff of the research Schemes for maize, rice and fungicides. Out of a total number of approved posts of ten, only four were filled.

---

* The Nigeria (Constitution) Order in Council, 1954. L.N. 102 of 1954.

In all, the Senior Staff position at March 1955 showed a total of 16 vacancies in an establishment of 30, and was as follows :—

Federal Department of Agricultural Research

	Present Staff	*Approved Establishment 1954-55*
Director of Agricultural Research	—	1
Research Adviser	1	1
Principal Research Officer	1	1
Senior Specialists	1	3
Specialists	6	10
Agricultural Superintendent	1	1
Laboratory Superintendents	—	2
Temporary Technical Publications Officer	—	1
Development Schemes		
No. D 2240—Agriculture		
Administrative Assistant	1	1
No. R471 and R471A Maize Rust Research		
Chief Research Officer	—	1
Senior Scientific Officer	1	1
Scientific Officer	1	1
No. R514 Rice Research		
Senior Specialist	1	1
Agricultural Officer	1	1
No. R565 Fungicides Research		
Senior Scientific Officer	—	1
Scientific Officers	—	2
Inspector of Works (Mechanical)	—	1
Total	14	30

The need to attract Scientists to undertake agricultural research in Nigeria is receiving attention by Government.

The Junior Staff position at March 1955 showed a total number of 32 vacancies in an establishment of 163 and was as follows :—

	Present Staff	*Approved Establishment 1954-55*
Chief Clerk	—	1
Assistant Chief Clerk	1	1
First Class Clerks	6	7
Second and Third Class Clerks	17	18
Clerical Assistants	6	7
Telephone Attendants	3	3
Messengers	8	10
Assistant Agricultural Officers, Grade I	2	4
Assistant Agricultural Officers, Grades II and III	3	5
Senior Agricultural Assistants	4	4
Agricultural Assistants, Grade I	3	4
Agricultural Assistants, Grades II and III	29	37
Field Overseers, Grades I and II	36	42
Artisans	1	2
Laboratory Attendants	3	6
Driver Mechanics	2	4
Temporary Field Staff	7	7
Temporary Clerical Staff	—	1
Total	131	163

Soil Survey and Investigations on Soil Fertility

Staff shortages did not permit any fundamental studies on soils or crop nutrition. It is hoped to be able to make a start when a Federal Chemist arrives towards the end of 1955. There is an urgent need for fundamental studies to provide information on which to base proper soil management, crop rotation, use of fertilizers and agronomic practices including land rehabilitation. Increasing demands on the available land, will be made in the near future in Nigeria, leading to reductions in bush-fallow periods. The need for increased production of food crops is generally recognised as a concomitant of plans for industrialization.

The application of ecological methods in solving problems of crop production in a relation to existing natural resources is not being overlooked. An ecologist has recently been appointed to the Federal Department of Agricultural Research and has already started survey work in two regions.

Improvement of Food and Cash Crops

Emphasis was laid on research on food crops during the period under review. In addition to research on maize and rice by the Colonial Development and Welfare Schemes, the arrival of additional staff permitted a start to be made with the improvement of cassava and yams. Further work on legumes which are important not only as sources of protein in the local diet but also from the view of pasture research, will be undertaken as staff becomes available.

Local cocoa hybrids maintained high yields and citrus root-stock trials continued to give valuable data on yield and disease resistance.

Control of Plant Diseases and Pests

Black-pod disease of cocoa caused by the fungus *Phytophthora palmivora*, accounts for an average annual loss of about 15 per cent of Nigeria's total crop. Recommendations made as a result of experiments carried out by the Principal Research Officer, have resulted in many farmers applying fungicide sprays to their cocoa trees for the control of black-pod disease. It is estimated that over one thousand farmers sprayed their trees in the course of 1954, and have consequently obtained yields which are double that of previous years when no spraying was done.

The arrival of an additional Plant Pathologist enabled a start to be made on the important study of diseases of food crops.

Swarms of the Desert Locust, *Schistocerca gregaria*, invaded the Lake Chad area of Bornu Province, egg-laying occurred and hopper bands subsequently caused some crop losses. Most of the hopper bands were destroyed before reaching maturity through the use of poison bait and by beating and by trenching. Air transport was used to supplement lorry transport for carrying bait in an area more or less devoid of roads. Approval was given for emergency expenditure up to £9,000 for this locust control campaign.

Inter-Territorial Research Institutes

The West African Cocoa Research Institute and the West African Oil Palm Research Institute, in common with other research organisations faced difficulties of staff shortages. Nevertheless steady progress was made. Meetings of Management and Technical Committees were regularly convened and attended throughout the year, and the research needs of all Regions in Nigeria were fully kept in view.

Good progress was made with the establishment of the Nigerian Sub-Station of the West African Cocoa Research Institute at Ibadan. A Senior Specialist was posted from the main Station at Tafo, in the Gold Coast, to act as Officer-in-Charge. The projected Staff for the Sub-Station is seven of which four were on duty during the period under review. A start has already been made in devising new techniques for the detection and control of outbreaks of the Cocoa Swollen Shoot Virus.

Four other members of the Institute's staff visited Nigeria during the year and close liaison was maintained.

Colonial Development and Welfare Research Schemes

West African Maize Rust Research Scheme

As a result of investigations carried out by the Maize Rust Research Unit, two improved varieties of maize, Sicaragua and Mexican I are now being multiplied by Regional Departments of Agriculture for distribution to farmers. Breeding work is continuing with the objective of incorporating resistance to corn borers and Helminthosporium disease, as well as to maize rust

Pathological studies included further observations on the epidemiology of the disease.

Nigerian Rice Research Scheme

The appointment of a Temporary Agricultural Officer enabled a staff of two to be posted to Badeggi, and good progress was consequently achieved in clearing the balance of the experimental site, and getting it in shape for experimental work. The building programme was temporarily delayed due to shortage of funds occasioned by increased costs of construction which were not anticipated when the scheme was originally drawn up. It is hoped to remedy this deficit shortly.

Regional Agricultural Research

The Annual Reports of the Regional Departments of Agriculture are compiled and published separately by the Regional Directors of Agriculture. They review policy and major developments, crop and livestock industries as well as activities of the Regional Department of Agriculture.

Visiting Missions

The report of the Mission organized by the International Bank for Reconstruction and Development which visited Nigeria in 1953, was published in September 1954. The Mission have recommended that the Federal Government should concern itself with basic agricultural research to be undertaken by an organization in the form of an agricultural research Institute working in close co-operation with the University College, Ibadan. A research staff double in size of the present Federal Organization has been projected by the Mission, with special emphasis on the need for increased research to overcome or minimize the effect of such limiting factors to crop and herbage production as soil deficiencies, inadequacy of water supply in certain areas, low yielding plant varieties, prevalence of plant and livestock disease and primitive cultivation methods. It was emphasized that the future welfare of the country and its capacity to support an increasing population will depend largely on increased production of food stuffs for local consumption.

The Mission's recommendations for the future organization of agricultural research are still under review by Government.

Many of the proposals, however, endorse action being taken at present by the Department of Agricultural Research. For example, priority has been given to research on food crops. One Botanist is devoting his attention to the improvement of cassava, and another is to work on yams. A special Colonial Development and Welfare team is devoting all its time to maize improvement, and another team is concentrating on rice at Badeggi. Research on soils and crop nutrition awaits the arrival of new staff, but consideration is also being given to a Colonial Development and Welfare Scheme to undertake research on the maintenance of soil fertility in regions of high rainfall. A Fungicide Research team is being recruited to study the possibility of controlling plant diseases by chemical means.

Other recommendations made by the Mission which have already been implemented, include the establishment of a Nigerian Sub-Station of the West African Cocoa Research Institute in the Western Region ; and the establishment of a Federal Plant Quarantine Station at Ibadan. The nutritional requirements of the oil palm are being actively pursued by the West African Institute for Oil Palm Research who have created a special Unit for this purpose and research on bananas is being conducted by the Cameroons Development Corporation who have appointed a Plant Pathologist in charge.

Mr C. R. Enlow, a specialist in improved pastures and Mr W. L. Dutton, a specialist in range management were the experts of a Mission organised by F. O. A. (formerly E.C.A.) to undertake a preliminary study of range and pasture resources in Nigeria (and Northern Rhodesia, Nyasaland and Kenya). The project resulted from a recommendation originally contained in the report by Messrs Lambert, McCall and Cline on a visit to Nigeria in 1949.

The Mission arrived in Nigeria on 14th June and stayed until 8th December, 1954. A report on the Mission's findings had not been received at the end of the period under review.

Interchange of Visits by Specialists to Neighbouring Territories

Dr J. M. Waterston, Research Adviser, and Mr J. T. Davey, Entomologist, represented the Federal Department of Agricultural Research at the Sixth Commonwealth Entomological Conference and the Fifth Commonwealth Mycological Conference held in London from 7th to 28th July. Other delegates from Nigeria who attended were Mr F. W. Toovey, Director, and Mr R. D. Allen, Research Officer of the West African Institute for Oil Palm Research, Mr R. M. Lister, Plant Pathologist, of the West African Cocoa Research Institute Sub-Station in Nigeria, Mr R. H. Cammack, Mycologist, of the West African Maize Rust Research Institute and Dr T. A. M. Nash, of the West African Institute of Trypanosomiasis Research.

Mr A. R. Maurer and Miss E. Harrison, Botanists of the Northern Region Research Station represented Nigeria at the second Anglo-French Agricultural Research Conference on groundnuts and millets held at Bambey, Senegal, from 6th-13th September, 1954.

Dr H. Vine, Senior Chemist, attended the 2nd Inter-African Soils Conference and the 5th International Congress of soil science at Leopoldville, Belgian Congo on 9th-14th August, 1954.

Mr W. D. Clayton, Ecologist, visited the West African Cocoa Research Institute at Tafo in the Gold Coast in connexion with studies on alternative hosts of the Cocoa Swollen Shoot Virus.

Mr J. E. Y. Hardastle, Botanist-in-Charge of the Nigerian Rice Breeding Station visited the West African Rice Research Station at Rokupr, in Sierra Leone to discuss research matters of mutual interest.

Mr J. T. Davey, Entomologist, continued to serve on secondment as a leader of a Mission in the French Sudan studying the African Migratory Locust.

Visiting Scientists from outside territories included Dr E. B. Worthington, Secretary-General, C.S.A., Belgian Congo, Mr F. C. Bawden, F.R.S., Deputy-Director and Dr C. B. Williams, F.R.S., Head of the Entomology Department, Rothamsted Research Station; Dr E. J. Hewitt, Long Ashton Research Station, Mr J. F. Gehr, United States Department of Agriculture, Foreign Agricultural Service; Dr W. V. Harris, Colonial Termite Research Unit; Dr E. W. Russell, School of Agriculture, Oxford University; Dr A. Muir, Rothamsted Research Station; Messrs A. Pickles, R. J. Benstead, A. D. McKelvie and Dr F. Raw of the West African Cocoa Research Institute, Gold Coast, Mr T. Jones, West African Timber Borer Research Institute, Gold Coast and Mr J. E. Mayne, Colonial Agricultural Machinery Advisory Committee.

Acknowledgement

Grateful acknowledgement is again made to the Commonwealth Agricultural Bureaux for invaluable assistance with many diverse technical problems.

J. M. Waterston,
Acting Director of Agricultural Research

31st July, 1955.

SECTIONAL REPORTS

Chemistry

Dr H. Vine .. .. *Senior Chemist*
H. Irving .. .. *Chemist*

Dr H. Vine was attached to the Western Region Department of Agriculture during the period under review as Officer-in-Charge of the Cocoa Soil Survey. An account of the work done will appear in the Annual Report of the Western Region Department of Agriculture for 1954-55.

Mr H. Irving, Chemist, transferred to the Northern Region Department of Agriculture with effect from 1st October, 1954.

It will not be possible to undertake a Federal Research Programme until further staff arrives. A Chemist is due to assume duty in 1955.

Botany

C. A. Thorold .. .. *Principal Research Officer*
S. R. Chant .. .. *Plant Pathologist*
B. D. A. Beck .. .. *Botanist*
W. D. Clayton .. .. *Ecologist*
A. O. Bamtefa .. .. *Agricultural Superintendent*

The arrival of three additional staff enabled a start to be made with the improvement of food crops, chiefly cassava, yams and legumes at Ibadan. Work on rice was based at the Federal Sub-Station at Badeggi.

Weather conditions were wetter than average and were characterized by a less severe dry season. This was reflected in a higher incidence of black-pod disease of cocoa. The wet conditions caused some damage at planting time through flooding.

METEOROLOGICAL DATA FOR MOOR PLANTATION, IBADAN, 1954

Months	*Rainfall* 1954 *in ins.* (*days*)	*Average* 1954-53 *in ins.*	1954 *Mean RH%* 0900 *GMT*	1954 *Mean Max.°F* 0900 *GMT*	1954 *Mean Min* 0900 *GMT*	1954 *Mean Temp.°F* 0900 *GMT*
January	0.82 (1)	0.28	82.1	89.9	68.3	79.1
February	1.91 (5)	1.12	82.2	91.9	71.7	81.8
March	6.89 (11)	2.45	81.7	91	71.2	81.1
April	8.16 (13)	5.60	84.3	89.3	70.6	80
May	3.00 (11)	6.30	82.9	88.7	70.1	79.4
June	6.75 (19)	6.97	85.6	85.4	69.7	77.5
July	1.25 (13)	5.88	86	81.5	68.5	75
August	2.97 (18)	3.38	87.8	79.9	67.4	73.4
September	4.79 (16)	7.62	86.6	84	69.1	76.5
October	11.30 (21)	7.18	84.6	85.7	68.6	77.2
November	4.08 (7)	1.96	81.8	89.7	69.7	79.7
December	— —	0.24	80.7	91.2	70.2	80.7
Total	51.92 (135)	48.98	—	—	—	—
Mean	—	—	83.8	87.4	69.7	78.5

Food Crops

Cassava.—(B. D. A. Beck). The improvement of cassava is a joint project of the Botanist, with the Senior Entomologist and the Plant Pathologist. The objective is to develop by selection and breeding, varieties resistant to mosaic disease which are at the same time better yielding and with a high protein content.

The classification of varieties on morphogenic characters is being attempted.

Yam.—A collection is being made of local Nigerian species and varieties in preparation of the arrival of a Plant Breeder in 1956 who will work on the improvement of this crop.

Maize.—(A. J. Vernon). A number of trials were conducted in the Eastern Region comparing imported varieties of maize with local types at Umudike, Abak, Aba, Nkwele and Abakaliki. All the imported varieties out-yielded the local ones, the two most promising being Sicaragua and Mexico I. Both are resistant to *Puccinia polysora* Underw., and are high yielding white grained types.

A number of experiments of agronomic interest were carried out in the Western Region on sowing dates, variety trials, etc., and details have been included in the Annual Report of the Western Region Department of Agriculture.

Tree Crops

Cocoa.—(B. D. A. Beck). The hybrid cocoa seedlings, progeny of the Nigerian selection T38 crossed with high yielding Trinidadian parents, continued to show their superiority in the 1942 Progeny Trial at the Ibadan District Council Cocoa farm at Odo Ona Nla. Yields are shown in Table 1.

Table 1.—Yield of nine types of cocoa seedlings in the thirteenth year after planting expressed in lbs wet beans per acre

Progeny Groups	*Yield in* 1954-55 *lbs wet beans/ acre*
Nigerian-Trinidadian Hybrids	
G. T38 × CF176 (Open pollinated seedling of I.C.S.4)	1,966
H. T38 × CF59 (Open pollinated seedling of I.C.S.1)	1,830
J. T38 × CF62 (Open pollinated seedling of I.C.S.1.)	1,736
Nigerian Parents selfed	
D. T38	1,243
E. CD176 (selfed seedling of T38)	1,243
F. CD207 (selfed seedling of T38)	1,110
Trinidadian Parents selfed	
A. CF176 (Open pollinated seedling of I.C.S.4.)	1,880
C. CF62 (Open pollinated seedling of I.C.S.1.)	1,190
B. CF59 (Open pollinated seedling of I.C.S.1.)	1,020
Significant Difference P = 0.05	707

Ecological Investigations—(W. D. Clayton). The work so far undertaken has largely been of an exploratory nature. It has included a small ecological survey at Fada, about 25 miles east of Ibadan, on an area that has already been the subject of a detailed soil survey. It was possible to show a close correlation between land use and soil type, and to map the land use patterns from aerial photographs. Some correlation between natural vegetation and soil type was also recorded, but this was frequently obscured by the effects of cacao or food crop cultivation. Observations were also made on the nature of the bush fallow succession, and on the possibility that indigenous plants might serve as alternative hosts of Cocoa Swollen Shoot Virus. The latter was considered unlikely in the Fada area. In addition, a small herbarium has been established, and about 200 specimens have been identified and added to it.

A tour was made to Kumba in the Cameroons in the company of Mr Thresh, Pathologist at W.A.C.R.I. sub-station, Ibadan, in order to search for and identify species of Cola. *Cola chlamydantha*, which has been shown to be an important alternative host of the Cocoa Swollen Shoot Virus in the Gold Coast, was said to be common around Kumba. This species was not found, but three related species, with which it had been confused, were collected. The susceptibility of these species to the virus will be tested.

Rice Research Scheme R514

J. E. Y. Hardcastle .. .. *Botanist-in-Charge*
J. O. Goss .. .. *Temporary Agricultural Officer*

Introduction

The period under review has been very much of a "pioneering" year and so progress in the field of research proper has been limited. However, the new year will open with a full complement of staff, a completely cleared experimental site of 75 acres, access roads, and irrigation and drainage channels constructed, and all formalities concerning acquisition of land completed. For the first time it is now possible to put into execution an experimental programme covering several fundamental aspects of rice research.

Building Construction Programme

Progress was made with the construction of Junior Staff Quarters, Office and Laboratory blocks and a seed store. The building programme ceased temporarily in February due to shortage of funds.

The Experimental Field

Of the total of 75 acres of fadama land at Badeggi acquired by the Rice Breeding Station, 25 acres were divided up into quarter acre beds with closely controlled irrigation. In these beds was raised the varietal collection. The remaining 20 acres was bunded on the contour at 8″ vertical intervals. Irrigation water was led in at the highest corner of the field and distributed through overflows in the bunds from one level to the next.

As a tractor and implements only became available for a comparatively short time before the rains set in and cultivation became impossible, the greater part of the 20 acre field was cultivated by hand by the local farmers. The bunds at 8″ vertical interval gave the best water control seen on the Badeggi fadama in 1954, but it was found possible to level the 20 acre field further after the completion of harvest, and extra contour bunds have now been thrown up to reduce the vertical interval to four inches. The whole of the 20 acres will be devoted to experimental work in 1954. With the aid of the new equipment acquired during the year the Agricultural Officer succeeded, during the latter quarter of 1954, in completely clearing, levelling and cultivating the remaining 50 acres of the experimental site. This area has also been contour bunded at four inch vertical intervals.

The Experimental Programme 1954

The rains started early, in March, but the first heavy rains fell in April followed by below average rains in May and June which delayed local planting. August rains were above average, declining steadily through September and October. Irrigation water assisted crop maturation in November, December and January.

Despite the large amount of pioneer work a programme of rice research was founded in the establishment of a varietal collection. Contributions from many sources in Nigeria numbered 300 plots and some 20 distinct varieties or strains. Detailed observations were taken on all varieties. These revealed that much of the material was mixed and even popular varieties exhibited several distinct physiological or morphological phenotypes. Selections were therefore made among all the varieties now popular in Nigeria in an attempt to provide an improved standard type of each one. Measurements are now being taken of the grain size of all varieties and an attempt will be made to classify them into one of the five grain size groups recognised by Eastern commercial producers. It will then be possible to confine selection to varieties possessing economically important grain types. This assumes an increase in production and a consequent demand by the millers for standardisation of varieties and improvement in quality.

Several medium early varieties, about which encouraging reports had been received, were grown in larger plots for observation along with BG 79, and G.E.B. 24. Of these only one was indicative of promise, being the variety MAS 2401, from Indonesia. Investigations will be pursued next year.

A series of uniformity trials were laid down upon the 20 acre field to indicate the optimum plot size for field experimentation. The uniformity trial will be repeated in 1956. A considerably more extensive research programme has been drawn up for next year including fertilizer trials and methods of cultivation.

Plant Pathology

The major research project of the Plant Pathology Section is on Cassava mosaic virus but diseases of yams, cocoa and citrus also receive attention. Other activities include the maintenance of a plant disease survey and a Plant Quarantine Service.

Cassava Mosaic—S. R. Chant

Symptomatology.—Studies are being carried out on the effect of mosaic on the leaf area of cassava with particular reference to variety GCH7, in an attempt to determine the effect of severity of symptoma on yield. Three main types of symptom are to be observed on the leaves of this variety *viz.* (*i*) mosaic only (*ii*) crinkling (with mosaic) and (*iii*) distortion and asymmetry (with mosaic). Indications are that there is a greater incidence of the symptoms of crinkling and distortion in the older leaves than in the younger while the opposite is true of leaves displaying mosaic only.

Transmission of the Virus.—This has been successfully accomplished by the methods employed by Golding (Trop. Agric. Vol. XIII No. 7, 1936). White flies *Bemisia sp.*, were collected from infected cassava in the field and introduced onto healthy seedlings in cages. Covers were placed over the cages for 24 hours to induce the white flies to settle on the plants. Mosaic symptoms appeared on young leaves 11-17 days after the introduction of the vectors. All attempts at mechanical transmission of the virus by inoculation of healthy seedlings with sap from infected leaves have failed.

Attempts at therapeutic control of the virus.—The following treatments were tested :—

(*i*) *Hot water treatment of cuttings.*—Work was begun in December to assess the effect of hot water treatment on infected cuttings. Treatments involved the immersion of cuttings in water at temperatures from 25° to 60°C for periods varying from 5 to 30 minutes. The results show that the thermal death point of the virus is higher than that of the cutting and that hot water treatments cannot be used successfully in the control of cassava mosaic. The growth of cuttings at high temperatures is being further investigated.

(*ii*) *Chemotherapy.*—Attempts have been made to reduce the symptoms of mosaic by chemotherapy. Infected cuttings were soaked in solutions (of varying concentrations from (0.1-0.025 per cent) of the following compounds : urea, sodium thiosulphate, hydroquinone and 8-hydroxy quinoline. After planting, the cuttings were also watered with the solutions but no reduction in symptom expression was observed.

Suspected Virus Disease of Yams—S. R. Chant

A suspected virus disease of yams taking the form of yellow chlorosis of the leaves was first noted by J. West in 1935 at Oyo.

In September 1953 the Regional Chemist Mr J. Kowal reported the disease as being present on yams in a fertiliser trial at Upper Ogun Estate and since then he has observed the disease on yams in the Oyo and Ogbomosho districts.

Mr T. A. Russell in 1953 observed the disease symptoms on yams at Upper Ogun as causing stunting and the production of spindly shoots, the leaves being long, very narrow and twisted. In less seriously affected plants, leaves showed mottling and a light streak along the veins.

A survey has been initiated to determine the distribution and economic losses caused by the disease, and to obtain material for further study.

A trial was carried out at Aponmu in Ondo Province, to compare Perenox with carbide-Bordeaux for black-pod disease control. After consideration of relative costs and copper contents of Perenox and copper sulphate, it was decided that Perenox should be tried at 0.4 per cent and at 0.25 per cent concentrations, *versus* 1 per cent carbide-Bordeaux. Each treatment was applied to a single block of cocoa, the areas of these blocks differed, but ranged between 8 and 10 acres (between 3,000 and 4,000 trees). There was an adjacent comparable block of 6 acres (3,492 trees) which was not sprayed. Groups of 100 bearing trees (one such group in each of the four blocks) were recorded individually. Spray treatments started in June 1954 and ended in November 1954. During this period eight applications of the three fungicide treatments (Perenox at 0.4 per cent and at 0.25 per cent, and 1 per cent carbide-Bordeaux) were given, at intervals of three weeks.

The results obtained are summarized in Table 2.

Table 2.—Mean numbers of total (healthy plus diseased) pods per tree, and number of black-pods expressed as percentage of total pods, in a trial of fungicide treatments

Treatment	*Percentage black-pods*	*No. total pods*
No spray	61.3 per cent	15.3
0.25 per cent Perenox	26.5 per cent	22.9
0.4 per cent Perenox	9.8 per cent	27.1
1 per cent carbide-Bordeaux	7.4 per cent	18.3

The table shows that the most effective control of black-pod disease was achieved through applications of 1 per cent carbide-Bordeaux (7.4 per cent black-pods), whilst 0.4 per cent Perenox was only slightly less effective (9.8 per cent black-pods), but at 0.25 per cent concentration there were considerably more black-pods (26.5 per cent). In the absence of spraying, there were serious black-pod losses (61.3 per cent). There is no indication that there was any harmful effect from spraying, on pod production, because the smallest number of total pods per tree was recorded for the untreated block (15.3) as compared with larger numbers (18.3, 22.9, 27.1) in the cases of sprayed blocks. It is of interest to note that 0.4 per cent Perenox is comparable with 1 per cent carbide-Bordeaux. Perenox spray mixture is easier to prepare but it has the disadvantage of not leaving a visible deposit on the pods, as contrasted with the conspicuous black deposit obtained after spraying with carbide-Bordeaux. On this account, Perenox applications may not be given thoroughly, because pods may escape treatment. Further experience should show whether the advantage of easy preparation outweighs the disadvantage of invisibility in the case of Perenox, for black-pod disease control.

Experiments on the control of black-pod disease by spraying were carried out by the Cocoa Survey Officer, Kumba, Cameroons, in 1953 and 1954, using 1 per cent carbide-Bordeaux. In 1953, spraying started on 2nd July and ended on 26th November, comprising eight applications at intervals of three weeks between applications. In 1954, there were only four applications. The first application was given on 29th April, 1954. Unfortunately, through lack of copper sulphate, the second application could not be given until 29th July, instead of on 10th June as was intended. The third application was given six weeks later, on 10th September, the fourth and final application was given on 22nd October 1954. The plots used were square areas of one acre containing trees planted at 13′ x 13′, but the numbers of bearing trees present ranged from 118 to 164 per plot. In both 1953 and in 1954 one plot was treated and a comparable plot was not treated. Trees were recorded individually. The amount of spray used averaged 48 gallons per acre per application in 1953 and 40 gallons per acre per application in 1954. The results from these spraying trials at Kumba are summarized in Table 3.

Table 3.—Mean number of total (healthy plus diseased) pods per tree and number of black-pods expressed as percentage of total pods in two seasons at Kumba

Treatment	*Percentage black-pods*		*No. total pods*	
	1953	*1954*	*1953*	*1954*
No spray	30.6	66.0	51.2	43.9
1% Carbide-Bordeaux ..	2.5	9.1	47.9	47.1

The Table shows that a satisfactory degree of black-pod control was obtained through applications of 1% carbide-Bordeaux at three-week intervals in 1953 (2.5% black-pods), and at six-week intervals in 1954 (9.1%), as compared with losses of 31% and 66% respectively, in the absence of spraying. It is probable that the smaller number of total pods recorded in the sprayed block (43.9) as compared with the untreated block (512) in 1953 was fortuitous because comparable numbers (47.9 and 47.1) were recorded in 1954. Therefore, there is no reason to suppose that there has been any harmful effect of spraying on pod production, whilst the degree of black-pod control was similar to that obtained at Aponmu in the Western Region of Nigeria.

Cocoa Seedling Die-back and Wilt.—S. R. Chant

A die-back and wilt disease caused considerable losses in seedlings of Upper Amazon seedlings in Western Region cocoa nurseries during the months of August, September and October.

It was first observed about 4 weeks after planting when the leaf tips began to turn brown. The discolouration spread along the leaf and was followed by wilting of the petioles and the top of the stem which also turned brown in colour. This was usually followed by death of the seedling although in less serious cases some seedlings recovered.

Several experiments were carried out in October and November 1954 to study the effect of environment on the incidence of wilt. From the results obtained it appears that humidity is an important factor in the incidence of wilt while the effect of shade is less noticeable. It is probable that shade is a complimentary factor to humidity, *i.e.*, the greater the shade the greater the humidity. This is borne out by the fact that during the period December 1954 to April 1955 when humidity was at its lowest there was only one report of a cocoa nursery suffering from the disease.

Attempts to isolate a pathogen have so far proved unsuccessful.

Concentric Ring Blotch of Citrus.—S. R. Chant

The disease of Citrus known as Concentric Ring Blotch was observed on sweet orange seedlings in the Moor Plantation nursery in February 1954. At the time it was so severe as to cause partial defoliation of the seedlings with subsequent weakening of the plant due to loss of effective leaf area.

In September 1954 a survey was carried out on all Western Region Production and Development Board and Agricultural Department nurseries and plots which had been planted up with sweet orange seedlings from Moor Plantation.

In all, 14 citrus nurseries and rehabilitation areas were visited in Ibadan Province but the disease was found in only two more localities, *viz.*, the Western Region Production Development Board nursery at Eleiyele and the Agricultural Department plot at Akanram.

The parent trees of the Moor Plantation Sweet Orange seedlings, *i.e.*, the varieties Agege No. 1 and Meran were inspected for the disease but both were symptomless.

It is suspected in South Africa that soil and climate are the chief factors concerned in the production of Ring Blotch and this is being further investigated. Age of the tree also appears to be an important factor.

In the Moor Plantation nursery and at Eleiyele the incidence of the disease has markedly decreased in seedlings which have reached the age of 18 months and in no case have been observed symptoms on plants of more than four years of age.

Transmission.—Attempts to transmit the disease have so far proved unsuccessful. When healthy stocks have been grafted with budwood taken from affected seedlings the symptoms have failed to appear in either stock or scion. However, the development of symptoms may be very slow. The effect of light intensity is being further studied.

Microscopic examination of sections of leaves showed no signs of a pathogenic organism in the tissues.

Maize Rust Research Scheme

Dr W. R. Stanton .. .. *Senior Scientific Officer*
R. H. Cammack .. .. *Scientific Officer*

The following is a summary of work undertaken by the Unit during the period under review. A full account will be found in the Annual Report of the unit for 1954 which is being published separately.

Breeding.—Yield testing and observations continue on material received from Central America and the Caribbean area. In particular selections have been made from the collection made by Brown* in his survey of maize of the West Indies. Maturity time and high yield are being investigated in crosses between a collection of inbreds received from Italy. These inbreds are the basis of many of the commercial double cross hybrids now used in Europe and the United States of America.

Further acquisitions from Minnesota (corn borer resistant lines) and Florida (Helminthosporium resistant lines) are being multiplied prior to testing.

The incorporation of 'polysora' resistance into white flour varieties is continuing but for reasons which are explained in the Unit's Annual Report for 1954, it does not appear to be essential to use the existing 'land' races of maize as the major source of germ plasm for the production of new varieties for West Africa.

During the year a survey was commenced of the maize types of West Africa to determine the preferences of different areas, the selection which has taken place and the store of genetic variation in indigenous maizes. Samples are being collected from all the West African Territories and these will be grown at Ibadan and at a Station in the 'Savannah' Zone to determine their characters under standard conditions.

Distribution of varieties.—As a result of trials of varieties derived from the Unit's collection, two varieties Sicaragua and Mexican 1 are now being multiplied by the Regions for distribution. Details are given in the Unit's Annual Report for 1954. They are based on the standard F.A.O. procedure described by Harrington.†

Genetics.—Critical work on investigation of the inheritance of rust resistance and the possibility of racial difference is in abeyance pending the construction of suitable glasshouses.

Pathology.—The Mycologist has continued to study the collection for pathogen resistance. Lines from temperate zones have in many instances succumbed to pathogens not normally serious in the indigenous and tropical maizes, and control measures have been necessary where these lines are required for breeding.

Assay plots laid out in stations in Nigeria and the Gold Coast have confirmed the previous year's observations on the pattern of rust attack. The lines in the assay plots have been consistent in their relative susceptibilities and time of onset has followed northward the advancing monsoon front of the rainy season.

An important part of the year's work has been the study of the changes in the air-spora both diurnally and with season. The advancing spore cloud of uredospores of the maize rust *Puccinia polysora* may be detected before the incidence of the disease is high at Ibadan. The aerial concentrations of the spores of other maize pathogens have also been recorded. The method used is that of the continuous recording spore trap described by Hirst.‡

* Brown, W. L. 1953. Maize of the West Indies. Trop. Agric. (Trinidad) 30 : 141-170.

† Harrington, J. B. 1952. *Cereal Breeding Procedures.* F. A. O. Rome.

‡ Hirst, J. M. 1952. An automatic Volumetric Spore trap. Ann. Anpl. Biol, 39 ; 257-264.

Entomology Section

J. T. Davey .. .. *Entomologist*
J. L. Gregory .. .. *Entomologist*

African Migratory Locust—J. T. Davey

Mr J. T. Davey continued his studies on the seasonal movements of the African Migratory Locust in its outbreak area the French Soudan.

In autumn 1953, the recapture of previously marked and liberated adult locusts showed that there was a movement of adult locusts from the Sahel zone (Farimake) to the Southern part of the flood plains of the River Niger. Observations had also suggested a subsequent gradual dispersion of locusts from the Southern flood plains to the North as more habitats were liberated by the receding floods.

Marking experiments were continued in 1954-55 to obtain more information on locust movements throughout the year.

Adult locusts first appeared in the Farimake in late August, presumably coming from the flood plains. Marking was started on October 1st at two sites in the Farimake, a total of 47,800 young adults being marked. Different colours were used in each locality. Of these locusts 24 were later recovered on the flood plains.

The main exodus of locusts from the Farimake occurred between 25th November and 27th, probably at night. The cause of sudden movement appears to have been a violent and dust-laden wind from the North and North East which started at 4.30 on 21st November and continued until the morning of the 27th. This wind was accompanied by a general lowering of temperatures during the day time with a slight increase above average at night, and followed by a very marked rise in relative humidities. Similar conditions accompanied the mass departure of locusts from the Farimake in 1953.

Throughout the later part of the rainy season, most of the flood plains were practically free of locusts. As the locusts left the Farimake in November so numbers rose on the Southern plains around Tillembeya. Marked locusts were recovered from this area. During December to February adult densities declined around Tillembeya and generally on the Southern plains and rose in adjacent sectors to the North East. From these sectors, seven more marked locusts were taken. All recorded movements were in the directions South or South West of the original areas in the Farimake and it seems unlikely that movements occurred in any other direction. Some further locusts marked near to Tillembeya were later recaptured to the North East, proving the dispersion through the flood plains.

The gradual dispersion of locusts throughout the plains further North occurred as more and more habitats were uncovered by the floods which were also retreating Northwards. The wettest habitats were the most favoured by the locusts and as the habitats dried out so they were abandoned. Unlike the flight from the Farimake, the dispersion throughout the plains appears to be a gradual process, locusts moving in relatively short distances.

All of the marked locusts except one were recovered in zones in which hopper bands always arise. Thus the locust movements described are bound to play an important part in the production of hopper bands and the formation of swarms of flying locusts.

Desert Locust—J. L. Gregory

On 5th August 1954, a swarm (or swarms) of Desert Locusts entered Bornu Province coming in a southerly direction from French Niger territory. Eggs were laid between Abadam, Bisagana and Darge. Three days later the swarm flew over Lake Chad and entered French Chad terrirory. The eggs began to hatch on 21st August and the emerging hopper bands moved westwards. Adults began to emerge on 20th September and the first spontaneous flight was noticed on 23rd September.

A further swarm entered Bornu Province and oviposited between Kukawa and Ngurtuwa on 8th August. Hoppers emerged on 2nd September and were eradicated before any adults developed.

Control Operations.—In the Kukawa area the swarm was eradicated by the local people under the District Head, entirely by trenching. Near to Abadam, about two-thirds of the hopper bands were destroyed by trenching and only one-third by means of poison bait. This was due to the shortage of insecticide and bran for bait induced by the condition of the roads between the area and the Provincial Centre.

The bait for the early hoppers was 2% Agrocide in guinea-corn bran but the strength was increased to 2.5% against later instars. Most of the poison bait was used in the moist state but dry bait was effective.

Transport.—The slow transport of supplies, owing to the nature of the country between the outbreak area and the Provincial centre, became the chief obstacle to speedy control of the locust swarm. Later, supplies of bran were dropped from a chartered Dakota aeroplane and the arrival of bait material was greatly speeded up.

The locusts were completely eradicated in the Kukawa area. Near to Abadam some adults emerged but no sizeable swarms escaped from the area and no further swarms oviposited in Nigeria during the year.

Studies on the Biology and Control of Beetles attacking Yams—J. L. Gregory

Three experiments were laid down at Effurun in Delta Province in March 1954 to test the effect of various treatments upon yam beetle damage and the yield of yams.

In previous experiments a B.H.G. dust applied to the seed yams before planting decreased yam beetle attack by 54% and increased yield by 5%. Several of these experiments had very low beetle attack rates and the corresponding figures for experiments with over 10% yams attacked were 56% damage decrease and 14% yield increase.

Experiment I.—B.H.C. has always proved the best insecticide for decreasing yam beetle damage. It was therefore decided to vary the quantity of B.H.C. per yam, by applying dusts of two concentrations of B.H.C. at two different rates of application. The more concentrated formulation was based on crude B.H.C.; in the more dilute, the gamma isomer alone was present.

The treatments applied to the yams before planting were :—

1. 0.5% B.H.C. dust at 1/20th oz. per yam.
2. 2.6% B.H.C. dust at 1/15th oz. per yam.
3. 0.5% B.H.C. dust at 1/6th oz. per yam.
4. 2.6% B.H.C. dust at 1/6th oz. per yam.
5. Control.

Results.—All treatments reduced damage significantly (Table 4). The higher strength of dust reduced yam beetle attack more than did the lower. Also, plots treated with the dilute dust at the lower rate of application were attacked more than those treated at the higher. The two rates of application of the stronger dust produced similar attack rates.

Table 4.—The effect of applying varying amount of B.H.C. dust to seed yams before planting

Treatment	1	2	3	4	5	*Significant Difference at 5%*
Weight of B.H.C. oz. per acre ..	0.9	6.3	3.0	15.7	—	—
Yield lbs per acre	9,700	7,150	9,300	8,600	8,400	940
Percentage of yams damaged ..	47	26	40	29	75	8

Decrease in damage did not result in equivalent increases in yield. The treatment which least reduced the attack rate caused the greatest increase in yield. Plots treated with the stronger dust yielded less than those treated with the weaker at both rates of application.

Thus while B.H.C. reduced yam beetle damage, it appears to have depressed yield. The difference between the two formulations may be due to the effect of the impurities in the crude B.H.C. but the purified B.H.C. formulation yielded less at the higher than at the lower rate of application.

Experiment II.—This was designed to confirm the results of previous experiments on yam beetle control. The layout was a 5×5 Latin square and the treatments were :—

(1) Oil Palm Fibre Mulch applied after planting.

(2) 5 per cent D.D.T. dust seed dressing applied at $\frac{1}{7}$th oz. per yam before planting.

(3) Control.

(4) 0.5 per cent B.H.C. dust seed dressing, applied before planting.

(5) B.H.C. Dispersible Powder in water applied before planting.

Results.—Treating plots with oil palm fibre mulch and B.H.C. dust gave increases in yield of 27 per cent and 21 per cent respectively over that of the control plots (Table 5). These differences were not statistically significant.

Table 5.—The effect of three insecticides and a mulch upon yield of yams and the attack rate of yam beetle

Treatment	*Oil Palm Fibre*	5% *D.D.T.*	*Control*	*B.H.C. dust*	*B.H.C. dispersible*	*Significant difference* 5%
Yield (lbs per acre)	8,500	7,500	6,700	8,100	7,100	Not significant
Percentage yams damaged ..	68	31	63	40	54	14%

The percentage of yams damaged was decreased by both D.D.T. and B.H.C. seed dressings both treatments showing significantly less damage than the other three treatments.

Although D.D.T. reduced yam beetle damage more than did B.H.C., the latter increased yield more. This might be due to a better early control of yam beetle activity by B.H.C. before the yam tubers had begun to form. The D.D.T. which is more persistent, might then be more effective in preventing visible damage to the new yam tuber after the B.H.C. had lost most of its insecticidal properties.

Experiment III.—This experiment was laid down as a 4×4 Latin Square to compare two additional insecticides, Heptachlor and Chlordane, against B.H.C. in its effect on yam beetle damage. All insecticides were applied to the yam before planting.

Both Chlordane and Heptachlor increased yield by about 50 per cent over that of the control plot (Table 6). Heptachlor reduced yam beetle damage more than did Chlordane. These insecticides are obviously of great interest since the yield increases were considerably greater than those due to B.H.C.

Table 6.—The effect of three insecticidal seed dressings on yield of yams and attack rate of yam beetle

Treatment	*Chlordane*	*Heptachlor*	*B.H.C.*	*Control*	*Significant Difference at* 5%
Yield (lbs per acre)	5,400	5,300	4,300	3,600	110
Percentage yams damaged	35	24	41	58	25

Tasting Trial.—The yams from the three experiments were bulked, yams from each treatment being kept separate. A sample of each was used for a tasting trial. Each yam was cut in half and the top of a yam from a treated plot compared with the bottom of one from an untreated plot after cooking and *vice versa.* Slight deterioration in taste was noticed in yams treated with the concentrated, impure B.H.C. formulation used in Experiment I.

Conclusion.—In the series of experiments started in 1950, where-ever more than 10 per cent yams were attacked by yam beetle, B.H.C. dust increased yield by an average of 16 per cent for six experiments. Assuming an average yield of yams of 6,000 lbs per acre (Table 38 "*Report on the Samples Census of Agriculture* 1950-51") this means an increase of 9 cwt per acre.

The cost of the dust needed for this at present prices is about £1 per acre.

The lowest price in any Region in the year March 1954 to February 1955 was 7*s*-3*d* per cwt at Ogoja in Ogoja Province (*Crop and Weather Reports, Eastern Region Department of Agriculture, November* 1954). At this rate the return would be £3-3*s*-0*d*. This does not take into account the improved value of yams due to their better appearance (the decrease in percentage of damaged yams in the experiments averaged 44 per cent).

Other insecticides have given greater increases in yield than B.H.C. this season, but require further testing.

Survey of Cereal Stem Borers of Nigeria.—J. L. Gregory

During the period September to November 1954, a survey of the cereal stem borers began in the Western Region of Nigeria.

The area covered included parts of the Freshwater Swamp Communities, Lowland Rain Forest, Derived Savannah and South and North Guinea Vegetation Zones (Keay, 1953, "*An Outline of Nigerian Vegetation*").

Observations were made in 103 localities and 140 fields of four cereal crops were inspected. One hundred plants were inspected at random in each field and any holes in the stems were opened. Borer larvae collected were preserved for later identification. Pupae were kept for rearing to the adult stage, but while on tour, many of these died. Only 22 per cent of the holes contained borers and 20 per cent were identified.

Total Infestation Rates.—The average infestation rates for the Western Region differ appreciably from those of the Northern Region (Table 7). The percentage of maize plants attacked was 50 per cent greater in the Western Region than in the Northern Region in 1951-52. The other three cereal crops in the Western Region suffered less borer attack than was found in the Northern Region Survey.

Table 7.—Percentage stem borer infestation rates of the major cereals of Western Nigeria in 1954

Crops	*Maize*	*Rice*	*Guinea-Corn*	*Sugar-cane*
Number of localities	87	32	18	11
Maximum Infestation Rate	66	58	36	26
Minimum Infestation Rate	7	9	7	4
Average Infestation Rate	33.2	18.6	17.6	12.6
Average Infestation Rate 1951-52 Northern Region	21.9	22.7	28.9	19.2

Species Attacking Crops.—Three species of borers attacked the cereals inspected in the survey, namely: *Busseola fusca* Fuller, *Sesamia calamistis* Hampson and *Eldana saccharina* Walk. *Chilo ignefusalis* Hampson was not recorded in the Western Region although it was of considerable importance on Guinea-corn and Millet in 1951-52. The attack rates of the three species on four cereal crops are given in Table 8.

Table 8.—Number of each stem borer species attacking cereal crops per 100 localities

Crop	Actual No. of localities surveyed	Busseola	Sesamia	Eldana
Maize	87	630	239	23
Rice	32	6	234	91
Guinea-corn	18	222	61	—
Sugar-cane	11	18	145	—

E. saccharina Walk was recorded only on maize and rice. *B. fusca* Fuller was the most common borer of maize and guinea-corn and formed 71 per cent and 78 per cent respectively of the identified borers of these crops ; it occurred on rice in one locality only. *S. calamistis* formed 71 and 89 per cent of the identified borers of rice and sugar-cane.

Survey by Vegetation Zones B.—fusca was the most common species attacking maize in the Lowland Rain Forest Zone and the Derived Savannah Zone where it formed 76 and 59 per cent respectively of identified borers. In the Southern Guinea Zone *S. calamistis* was dominant on maize and accounted for 80 per cent of indentified borers.

The total infestation of maize was higher in the Lowland Rain Forest Zone (36 per cent) than in the Derived Savannah (29 per cent) and Southern Guinea (15 per cent) Zones.

S. calamistis formed 70 and 75 per cent of identified rice borers in the Derived Savannah and Lowland Rain Forest Zone respectively. The total infestation of rice was approximately equal in the two zones (19 and 21 per cent respectively).

The most important borer of Guinea corn in all vegetation zones was *B. fusca* which accounted for 71, 60 and 91 per cent of all identified borers in the Lowland Rain Forest, Derived Savannah and Southern Guinea respectively. The total infestation in the three zones was 23, 11 and 22 per cent respectively.

Sugar-cane was recorded only in the Lowland Rain Forest and the Derived Savannah Zones. *S. calamistis* formed 88 per cent of all identified borer in the former and 100 per cent in the latter zone.

Control of Maize Stem Borers.—J. L. Gregory

In previous experiments significant increases in yield have usually followed the use of Endrin on young maize plants.

Early Maize Experiment.—An experiment was laid down at Ibadan to compare the effect of Endrin with that of six other insecticides upon yield and the number of maize plants attacked by stem borers.

The insecticides were applied at three different concentrations (Table 9) when the plants were about 24" high, until run off occurred from all leaf axils. Fourteen days later a further application was given to half of the treated plots. The maize variety was Lagos White.

Table 9.—Strengths of insecticides in early maize stem borer control experiment

Insecticides	Formulation	Concentrations Percentage		
		1	2	3
Heptachlor	Wettable powder	0.164	0.082	0.041
Chlordane	Wettable powder	0.098	0.049	0.025
B.H.C.	Wettable powder	0.026	0.013	0.006
Aldrin	Emulsion concentrate	0.064	0.032	0.016
Dieldrin	Emulsion concentrate	0.136	0.068	0.034
Endrin	Emulsion concentrate	0.068	0.034	0.017
D.D.T.	Emulsion concentrate	0.124	0.062	0.032

After the first application scorching was observed on some plots. Plants were not damaged by Heptachlor and only a little damage occurred on those treated with the highest concentration of Aldrin and Chlordane. D.D.T., Dieldrin and Endrin caused no damage at all, and B.H.C. Wettable powder at the two highest concentrations.

Results.—No significant increase in yield followed any treatment although the number of attacked plants at harvest time was 54 per cent and 40 per cent lower in plots treated by Heptachlor and Endrin respectively. (Table 10).

The three concentrations did not differ significantly in their effect on yield or infestation rates.

Two applications of insecticide reduced borer attack significantly more than one but neither increased yield significantly.

Table 10.—Effect of various insecticides applied to early Maize

Treatment	*Heptachlor*	*Chlordane*	*B. H. C.*	*Aldrin*	*Dieldrin*	*Endrin*	*D. D. T.*	*Control*	*Standard Error*	*Significant Difference at 5%*
Yield in lbs dry grain per acre	326	311	318	315	300	308	286	316	96	Not significant
Percentage of Plants attacked	4.5	7.0	7.8	8.8	6.3	5.9	7.0	9.8	1.6	3.2
Percentage of Joints attacked	0.45	0.75	0.77	0.87	0.52	0.54	0.62	1.06	1.16	0.32

This experiment confirmed that, as shown in earlier experiments, little increase in yield could be obtained by controlling stem borer attack on the early maize crop.

Late Maize Experiment.—In this experiment five insecticides only were used since B.H.C. and D.D.T. have consistently been ineffective against stem borers. In the early maize crop experiment four of the five insecticides damaged the crop at the highest of the three concentrations used so this was omitted.

Observations on borer damage were made at weekly intervals after the final thinning.

The variety of maize was Sicaragua which explains the higher yields obtained in the late crop.

Table 11.—The effect of some insecticides upon yield and stem borer attack on late maize

Insecticide	*Aldrin*	*Dieldrin*	*Endrin*	*Hepta-chlor*	*Chlor-dane*	*Control*	*Stan-dard Error*	*Signifi-cant Diffe-rence at 5 per cent*
Yield lbs. dry grain per acre	1,630	1,550	1,760	1,730	1,570	1,430	66	130
Ozs. dry grain per cob	9.2	8.9	9.6	9.4	9.0	8.9	0.3	Not significant
No. of cobs per acre ..	6,780	6,720	7,050	7,020	6,720	6,210	162	320
No. of plants per acre at harvest	7,400	7,450	7,530	7,560	7,300	6,950	137	270
No. of cobs per plant ..	0.917	0.903	0.935	0.928	0.922	0.894	0.014	0.027
Percentage plants attacked	10.9	10.2	9.5	9.3	9.6	10.5	1.2	Not significant
Percentage Joints attacked	1.31	1.18	1.10	1.09	1.15	1.65	0.23	Not significant

Endrin and Heptachlor increased yield by 23 per cent and 21 per cent respectively although no significant difference between borer infestation rates was noted (Table 11).

The difference in yield was due largely to the difference in the number of cobs produced since applications of insecticides did not significantly alter the weight of grain per cobs.

The number of cobs was determined by the number of plants at harvest time and by the number of cobs per plant both of which were significantly affected by insecticidal treatments. Thus the percentage infestation at harvest did not accurately represent the value of insecticidal applications.

There were no significant differences between the two concentrations nor between one and two applications of insecticide.

STUDIES ON THE CONTROL OF THE CAPSID PESTS OF COCOA.—J. L. GREGORY

Two types of experiment were continued during the year, namely, the paired plots and the scale dusting experiment at Akola.

Paired Plots.—The two plots at Ondo and Ado-Ekiti were not dusted during the year but observations were continued to determine whether capsids would increase when dusting ceased.

Capsids in both localities remained low although the number in the treated plot at Ondo was slightly higher than it had been in the previous year. The population in the treated plot at Ado was slightly lower.

In both localities, the population in the treated plots remained considerably lower than in the untreated ones even though no dusting took place, presumably because of the relative scarcity of chupons on the less damaged treated plots.

The number of green pods per 100 trees reached similar maxima on the treated plots as in the 1953 season but the number of green pods on the untreated plot rose slightly on both plots and the ratio of green pods treated plot/untreated plots, decreased (Table 12).

Table 12.—Summary of unripe pod counts on paired plots 1951-54

Locality	*Ado-Ekiti*			*Ondo*		
	Treated	*Untreated*	*Ratio Treated/ Untreated*	*Treated*	*Un-treated*	*Ratio Treated/ Untreated*
July-December 1951 ..	17,557	13,032	1.35	4,673	7,063	0.66
July-December 1952 ..	9,186	9,672	0.95	9,106	7,578	1.20
July-December 1953 ..	10,923	5,768	1.89	7,386	4,782	1.54
July-December 1954 ..	11,965	7,466	1.60	7,344	6,282	1.17
1952	22,441	18,995	1.18	21,737	22,315	0.97
1953	17,725	8,025	2.21	13,459	8,854	1.52
1954	18,937	10,288	1.84	11,311	9,556	1.18

Large Scale Trial.— The treated plot was dusted on 14th to 17th August, 28th to 30th December, 1954 and 26th to 28th February, 1955.

The capsid populations throughout the year were much lower than in 1953, the maximum number of bugs in the untreated plot being less than half that of 1954. The maximum in the treated plot was only slightly less than in the previous year.

The populations were above the level at which appreciable damage normally occurs on 16 counting periods in the untreated and six in the treated plots in 1953-54. In 1954-55, the figures were nine and six respectively.

The dust was observed to decrease the population in the untreated zone over the period of the trial while exerting a greater control on the treated plot.

The populations in both the treated and untreated plots began to rise about the end of November (a month later than in the previous year). They also began to decrease two weeks later than last year from the maximum population.

The green pod ratio treated trees/untreated trees was slightly higher during the period August 1954 to March 1955 than it was during the same period in the previous year, averaging 0.95 as opposed to 0.88 in 1953-4.

The total number of green pods was slightly higher in the untreated plot than in 1953, the maximum recorded number being 634 as opposed to 590 in the preceding year. The green pod total on the treated plot reached a maximum over 70 per cent greater than in the previous year.

The number of green pods per 100 trees was always greater in the treated than the untreated plot except for a period from mid August to mid February. The yield on the treated plot has thus increased considerably since 1953.

The scores for leaf blast damage were greater on the untreated than on the treated plot throughout the year.

Publications

CAMMACK, R. H.

1954. Observations on *Puccinia polysora* Underw., in West Africa. Report on Fifth Commonwealth Mycological Conference 46-48 (Summary).

CHANT, S. R.

1955. Concentric Ring Blotch of Citrus. Comm. Phytopath. News 1 : 9.

DAVEY, J. T.

1955. A preliminary note on seasonal movements of the African Migratory Locust in the solitary phase. Locusta Bull. No. 3 : 1-4.

GREGORY, J. L.

1954. Review of work by the Entomological Section, Department of Agriculture, Nigeria 1948-54 in Report of the Sixth Commonwealth Entomological Conference, London, 290-302.

THOROLD, C. A.

1954A. Control of black-pod disease (*Phytophthora palmivora*) of Cacao by fungicide in the Western Region of Nigeria. Report on Fifth Comm. Myc. Conf. 97-102.

1954B. The use of ultra-violet fluorescent substances for observations on dispersal of *Phytophthora palmivora* Sporangia. Nature 174 : 409.

1955. Observations on *Theobroma cacao* in Fernando Po. Jour. Ecology 43 : 219.

VINE, H.

1954A. Latosols of Nigeria and some related soils Proc. Second Inter-African Soils Conf. 1 : 295-308.

1954B. Is the lack of fertility of tropical African soils exaggerated ? Proc. Second Inter-African Soils Conf. 1 : 389-412.

VINE, H. and V. J. WESTON,

1954. Progress of work on the management of the soil since 1948. Proc. Second Inter-African Soils Conf. 2 : 1049-1094.

VINE, H., WESTON, V. J., MONTGOMERY, R. F., SMYTH, A. J., AND MOSS, R. P.

1954. Progress of soil surveys in South-Western Nigeria. Proc. Second Inter-African Soils Conf. 1 : 211-236.

PUBLICATIONS

The following is a list of some of the Government Publications which may be obtained (post free in Nigeria) from The Federal Government Printing Department, Lagos. A complete list may be obtained gratis on application.

Money Orders and Postal Orders should be made payable to The Federal Government Printer, Lagos. Postage stamps are not accepted.

Geological Survey Bulletins

No. 5—The Tinfields of Nassarawa and Ilorin Provinces, *Raeburn*, 5*s*.

No. 10—Eocene Fishes from Nigeria, *White*, 6*s*-3*d*. Tinstone in Calabar District, *Raeburn*; 10*s*.

No. 18—The Sedimentary Rocks of Sokoto Province (*Brynmor Jones*), 7*s*-6*d*.

No. 19—The Geology of the Plateau Tinfields—Resurvey 1945-8 (*Dr Dixey*), 12*s*-6*d*.

No. 20—The Geology of the Osi Area, Ilorin Province (*B. C. King & A. M. J. de Swardt*), 10*s*-6*d*.

No. 21—Land use and Soil Conservation in Parts of Onitsha and Owerri Provinces (*A. T. Grove*), 10*s*-6*d*.

No. 22—Land use and Soil Conservation on the Jos Plateau (*A. T. Grove*), 10*s*-6*d*.

No. 23—The Geology of the Country around Ilesha (*A. M. J. de Swardt*), 10*s*-6*d*.

No. 24—The Nigerian Coalfield—The Geology of Parts of Onitsha, Owerri and Benue Provinces (*A. Simpson*), 10*s*-6*d*.

Legal

Nigeria Law Reports, Vols. 2 and 19, 10*s*-6*d* each.

West African Court of Appeal selected judgments, Vols. 8 and 11, 10*s* each.

Miscellaneous

A Guide to Posts in the Permanent Establishment of the Senior Service of Nigeria. Price 3*d* per copy:—

N.S.S. 1. General Conditions of Service.
N.S.S. 7. Civil Aviation, Meteorological, Public Works.
N.S.S. 8. Colliery, Mines.
N.S.S. 9. Commerce and Industries, Co-operative and Statistics.
N.S.S. 10. Customs and Excise and Marine.
N.S.S. 11. Education.
N.S.S. 12. Electricity, Posts and Telegraphs.
N.S.S. 13. Geological Survey, Land, Survey.
N.S.S. 15. Police, Prisons.
N.S.S. 16. Railway.

Abstract Factories Ordinance, 6*d*.

African Education, 8*s*-6*d*.

Companies Ordinance Form E, 1*s*-6*d*.

Companies Ordinance Forms 1 to 7 and Forms 1F to 7F, 1*s* each.

Customs Order in Council (Legal Notice No. 97/1954), 6*d*.

Gorsuch Report, 6*s*.

Eastern Region Scholarship Scheme of 1952, 6*d*.

General Orders (Buckram Covers), £3.

Nigeria Trade Journal Vol. 4, No. 3, 1*s*-6*d*.

Policy for Public Works, S.P. 8/1953, 6*d*.

Policy for Survey, S.P. 5/1953, 6*d*.

Proceedings of the General Conference of the Constitution, Jan. 1950, 1*s*-6*d*.

Select Committee of Eastern House of Assembly set up to Review the existing system of Local Government in the Eastern Provinces, 6*d*.

Short Guide to the Factory Ordinance, 6*d*.

Ten-Year Education Plan, 2*s*.

Trade Test Syllabus, 6*d*.

Tribunal of Inquiry, Lagos, Evidence Day III–X, 5*s* each.

White Paper on Gorsuch Report, 9*d*.

White paper on Randell Report, 1*s*-6*d*.

Public Records

Staff List, April 1954, 7*s*-6*d*.

Federal Staff List, April 1955, 1956 at 7*s*-6*d* each.

Nigerian Periodicals and Newspaper, 2*s*-6*d* (obtainable from the Librarian, University College, Ibadan).

Preservation and Administration of Historica Records and Establishment of Public Records Office in Nigeria, 9*d*.

Road Guide of Nigeria, 10*s*.

Anthropological Publications

A Modern Grammar of Spoken Hausa, *Abraham*, 6*s*

Dictionary of the Hausa Language, *Abraham*, 20*s*.

English-Kanuri Sentence Book, *Ellison*, 10*s*.

Fulani of Northern Nigeria, *de St. Croix*, 2*s*.

Hausa Fulani Proverbs, *Whitting*, 6*s*-6*d*.

Population Census of Lagos, 1950, 20*s*.

Population Census of Nigeria, 1952-53, 5*s*.

Population Census, Northern Region, 20*s*.
Bulletin No. 7—Bornu Province, 5*s*.

Population Census, Western Region:—
Bulletin No. 6—Benin Province, 5*s*.
Bulletin No. 7—Ibadan Province, 5*s*.
Bulletin No. 8—Abeokuta Province, 5*s*.

Population Census, Eastern Region:—
Bulletin No. 4—Ogoja Province, 5*s*.
Bulletin No. 6—Calabar Province, 5*s*.
Bulletin No. 7—Onitsha Province, 5*s*.
Bulletin No. 8—Owerri Province, 5*s*.

Population Census and Table, Eastern Region, 1953 20*s*.

Population Census and Table, Northern Region 1952, 20*s*.

Principles of Hausa, 10*s*-6*d*.

Sobo of the Niger Delta, *Rev. J. W. Hubbard*, 21*s*.

14-11-56
13-1-57
9-2-57
2-3-57

2661(56)/357/1,200 (4)